Ethiopia maps the danger zones

Africa's Great Rift Valley slices through the heart of Ethiopia, from the Red Sea in the North to the Southern border with Kenya. Within this seismic fault system, the junction of three active rift zones — the Ethiopian Rift, Red Sea Rift and Gulf of Aden Rift — lie many of Ethiopia's important cities.

Seismic activity is frequent in this region. In Ethiopia alone, this century, the city port of Massawa was destroyed by earthquakes in 1921; in 1961 three thousand tremors were recorded from the centre of Wollo province, opening a fissure 20 kilometres long on the slopes of the Borkena graben and severely damaging villages and roads; in 1960 the village of Serdo in the Danakil desert was destroyed and 40 people killed.

Yet Ethiopia has no set of construction standards to minimize the vulnerability of its buildings. Until recent years damage, outside the larger cities, was slight: traditional houses, made of adobe reinforced with eucalyptus frames and roofed with thatch, could withstand most shocks. Today, however, experts are viewing with some alarm the erection of highrise buildings on the edge of major tectonic faults.

The destruction of Managua, Nicaragua, in December 1972 by earthquakes of an intensity experienced in Ethiopia every four to five years underlined to the Ethiopian government the importance of drafting building security codes. In 1973 the Ministry of Public Works requested the assistance of the Geophysical Observatory of Haile Selassie I University in preparing seismic maps and in estimating possible seismic risks for each sector of the country.

The director of the observatory, Dr. Pierre Gouin, a Canadian, had for 15 years been involved in cataloguing seismic activity in Ethiopia. Scanning through historical documents wherever they were to be found, he had recorded close to 500 events (an "event" can be any recordable seismic disturbance from a minor tremor to a major quake) covering the years between 1400 and 1974.

The task had not been easy: historical data was biased towards the north of the country where, in Eritrea and Tigre, monk-historians had kept records. Although the south of the country is believed to be as active, only legends — and the still active Rift Valley — were available to document events.

Other problems cropped up. Isoseismal maps made by an Italian, De Castro, of the 1906 earthquakes near Addis Ababa could not be found. Dr. Gouin doubts their validity in any case: "How could one estimate the possible damage when there is nothing to be damaged?" he says.

Events recorded by the one seismic station in the country gave no indication of the location of the epicentres or of the maximum intensity felt during the events. And although a seismic station had been installed at Asmara during a particularly active period in 1913, the seismograms had been lost during the first world war.

With IDRC assistance Dr. Gouin set out to complete the data and then list each event on computer cards. As Ethiopia has no computer facilities capable of handling the computations, this stage was carried out with the participation of the Victoria Geophysical Observatory in Victoria, Canada.

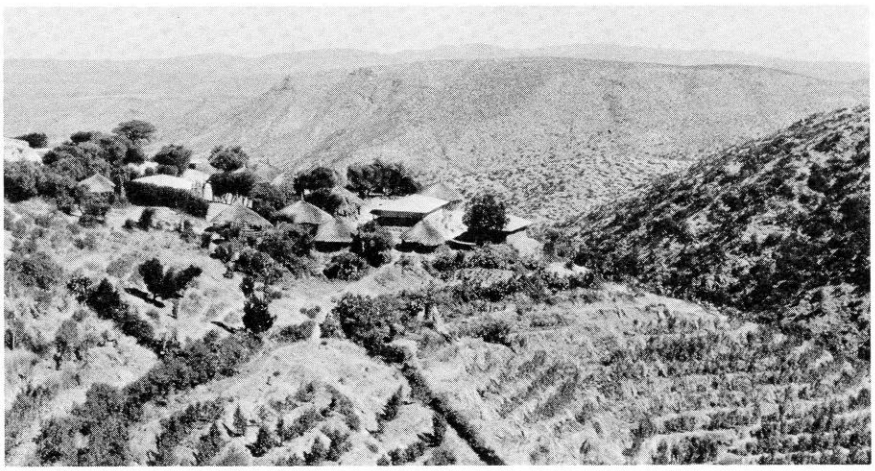
The resulting documentation includes plots of epicentres in the Horn of Africa, computations of intensity for 258 points in Ethiopia for the period of 1630 to 1974, as well as for the release of energy and strain over the whole country. The probability of seismic hazards for periods ranging from three to a thousand years was also determined. Dr. Gouin jokingly measures his 18 years of painstaking work by the close to 100 lbs of computer print-outs he carried back from Victoria.

Now back in Ethiopia Dr. Gouin is analyzing the computer results. The final report is expected this year to which will be appended seismic risk maps detailing at a scale of 1:1,000,000 the location of epicentres and intensity of tremors, the crustal profile, the acceleration and intensity of energy release and seismic zoning.

The project's most significant impact is expected to be on civil engineering work. Urban buildings such as schools, hospitals and bridges will be erected on more secure foundations. The specifications devised as a result of the project may also have applications to structures in the countryside such as dams.

A long and difficult task anywhere — it took Canadian seismologists 17 years to revise the 1953 Canadian seismic risk map — the preparation of seismic zoning maps is considered of primary importance in Ethiopia, now in the process of relocating its provincial capitals. And while Dr. Gouin warns that these maps are preliminary and will need to be revised as new information is found, they may help Ethiopia avoid the disasters that Guatemala has recently endured. □

The poor cannot afford expensive anti-earthquake construction, so low-cost housing suffers the greatest damage (left).



The Rift Valley in Ethiopia (right) — it also passes through many of the country's major cities.

Photo: Neill McKee